DOCUMENT RESUME

ED 098 034 SE 016 597

AUTHOR	Alden, John D.
TITLE	What's Different About Engineering Students? Engineering Manpower Bulletin Number 24.
INSTITUTION	Engineers Joint Council, New York, N.Y. Engineering Manpower Commission.
PUB DATE	Jul 73
NOTE	6p.
AVAILABLE FROM	Engineering Manpower Commission, 345 East 47th Street, New York, NY 10017 ($2.00)
EDRS PRICE	MF-$0.75 HC-$1.50 PLUS POSTAGE
DESCRIPTORS	*Career Choice; *Engineers; Occupational Guidance; *Research; *Subprofessionals; Surveys

ABSTRACT

Reported is an analysis of responses obtained from 51,600 high school seniors in the state of Indiana. Of these seniors who graduated with the class of 1972, 2,000 gave engineering as their vocational choice; another 1,200 indicated that they planned to become technicians. Summarized are differences in the characteristics of the students, their vocational plans, and the reasons why they choose certain vocational fields. Similarities and differences between those selecting engineering and technical vocations are compared to those selecting other vocations. Having family members in an occupation or being in close contact with someone working in a particular field appear to be important factors influencing the career choice of students. (RH)

BEST COPY AVAILABLE

ED 098034

ENGINEERING MANPOWER BULLETIN

NUMBER 24
JULY 1973

U.S. DEPARTMENT OF HEALTH EDUCATION & WELFARE NATIONAL INSTITUTE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

This is the twenty-fourth in a series of Bulletins designed for leaders in industry, education, and government whose responsibilities include an awareness of developments affecting engineering and technical manpower. In this issue we present selected highlights from a survey of high school seniors conducted by Purdue University for the State of Indiana. We are indebted to Professor J. P. Lisack, Director of the Office of Manpower Studies, Purdue School of Technology, for providing the data on which this Bulletin is based.

JOHN D. ALDEN, *Executive Secretary*
Engineering Manpower Commission of
Engineers Joint Council

WHAT'S DIFFERENT ABOUT ENGINEERING STUDENTS?

Last year the Purdue University Office of Manpower Studies conducted a major survey of high school seniors in the state of Indiana to ascertain information about their vocational and educational plans.* Although the data pertain only to students in that state, whose characteristics may not be typical of other areas, they are of particular interest to people concerned with engineering manpower because the statistics have been broken down according to major vocational interest fields among which engineering has been separately identified. The results of the survey thus lend themselves to a comparison of the characteristics of students choosing engineering versus those choosing other occupations. Some of the differences revealed may be quite significant in enabling engineering to recapture the interest of bright young people who have seemed to be "turned off" to the profession in recent years.

GENERAL CHARACTERISTICS

The survey obtained responses from 51,600 high school seniors of the class of 1972. Of these, slightly over 2,000 gave engineering as their vocational choice. Another 1,200 indicated that they planned to become technicians. The survey statistics show that both of these sub-groups differ substantially from the broader Professional & Technical group of which they are a part, as well as from the Managerial, Clerical, Service, Agricultural, and Skilled Worker occupational categories. For instance, the entire Professional & Technical group was divided 50:50 by sex, but within this broad grouping the ratio of males to females was 70:30 for technicians, 35:65 for high school teachers, and 97:3 for engineers — no other group had so low a percentage of young women. This, of course, is not a new finding, but it serves to illustrate how easily differences can be obscured when aggregate groups are not analyzed in detail. For the other groups covered, Agricultural, Skilled Workers, and Managerial were 81 to 93 percent male, while Clerical was 90 percent and Service 73 percent female. These sex characteristics undoubtedly are closely correlated to some of the other findings of the survey.

HIGH SCHOOL PREPARATION

Most students choosing engineering had pursued college preparatory courses and had good grade averages, but there were some significant exceptions. Figure 1 shows the distribution by type of high school program of the six major career groups. It will be observed that the college preparatory program was the predominant source of students planning to go into teaching. Similarly students choosing clerical careers tended to come largely from the business education program, while the service and skilled groups came mainly from general and vocational programs.

Perhaps the most interesting observation about the prospective engineering students is the large percentage having general or vocational preparation. Since these programs are not specifically aimed at equipping the student for admission to an engineering college, it is possible that some of these students may have unrealistic objectives. In the case of the technician students, the high proportion (41%) with a college preparatory background also raises some questions. Presumably many of these students could satisfy the entrance requirements for an engineering program. Taken together, the statistics for these two groups suggest that there may be confusion in the minds of some students as to the difference between engineers and technicians, the educational preparation involved, and the different admission requirements for the two types of programs. By contrast, the students desiring to become high school teachers seem to have a much clearer focus on the relationship between their high school curriculum and their college aspirations.

**Changing Trends in the Plans of High School Seniors*, Manpower Report 73-1, 1 February 1973, by Prof. J. P. Lisack, Purdue Univ. SCC-A, Lafayette, Ind. 47907, $2.00

SE 016 597

BEST COPY AVAILABLE

High School Concentration as a Function of Vocational Choice

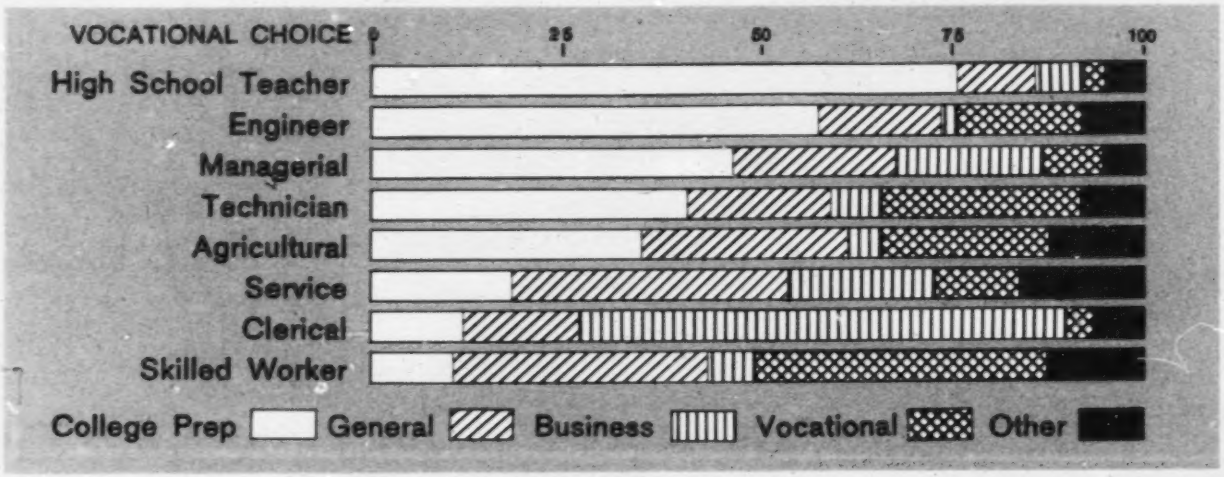

FIGURE 1

GRADE AVERAGE

As would be expected, students planning to go into engineering or teaching tended to have high scholastic averages. However, Figure 2 indicates that the grades of the propective engineers centered between B and C whereas those of the would-be teachers were between A and B. A majority of the technicians, however, were C students, in which respect they differed noticeably from the rest of the professional & technical group and resembled the other occupational groups identified in the survey. Among the A and B students taken separately, engineering was not a particularly popular choice, being selected by only 6 percent of the A students and less than 4 percent of the B group.

The fact that over 40 percent of the students indicating an interest in engineering had a C average or lower could prove to be a handicap in their obtaining admission to an engineering program. In this respect, as in the type of preparation, the expectations of many students may be unrealistic.

COLLEGE PLANS

Only 45 percent of the students choosing engineering and 32 percent of the technicians indicated that they intended to go directly into a full-time educational program, while 22 percent of the engineers and 34 percent of the technicians planned to take part-time studies. Also, 19 percent of the engineers and 15 percent of the technicians planned to enter full-time employment immediately after leaving high school. The balance checked military service or other activities. Two thirds of the prospective high school teachers, however, intended to go directly into full-time college programs.

Grade Average as a Function of Vocational Choice

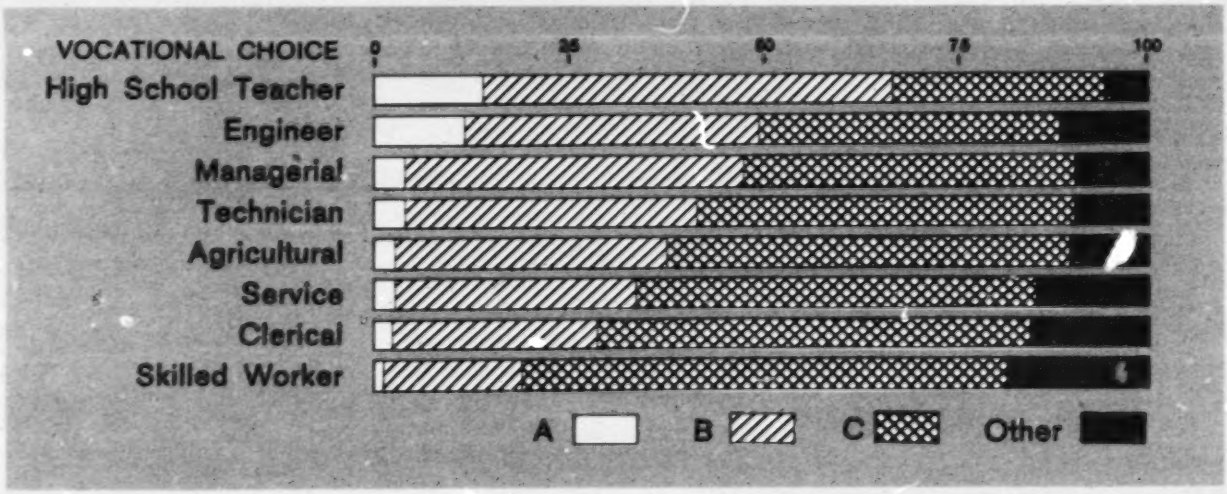

FIGURE 2

BEST COPY AVAILABLE

Reasons for Selecting a Certain School as a Function of Vocational Choice

VOCATIONAL CHOICE	OFFERS WHAT I WANT TO STUDY	LOCATION NEAR HOME	AMOUNT OF TUITION	SIZE OF SCHOOL	PREFERENCE OF PARENT	COUNSELOR OR TEACHER SUGGESTION
Engineer	48%	11%	4%	3%	2%	2%
Technician	45	17	5	2	2	2
High School Teacher	39	15	8	8	4	2
Managerial	32	14	5	4	3	3
Agricultural	29	7	3	2	1	1
Skilled Worker	22	8	2	1	1	1
Service	21	9	3	1	2	1
Clerical	18	8	2	2	1	1

TABLE 1

Of the seniors who planned to enter college, those choosing engineering or technology were most likely to select a school on the basis that it offered the kind of program they wanted. (Table 1) Location near home, amount of tuition, size of school, and preferences of parents were minor factors in determining choice of college. The engineering students did not differ appreciably from the teachers in plans to finance their education. Both groups intended to rely on family support, part-time work, personal savings, scholarships, and loans in that order. The technicians, however, were much less inclined to expect scholarship aid.

In terms of the level of college program initially planned, students who planned to enter teaching overwhelmingly indicated baccalaureate or higher degree programs (Figure 3). Only 50 percent of the engineers and 13 percent of the technicians indicated BS degree programs, while 22 percent and 58 percent respectively selected programs of less than four years duration. Rather surprisingly, nearly a third of the engineers and technicians did not know or did not report the length of college program expected. When asked about graduate or professional training after completing their undergraduate work, 62 percent of the teachers, 41 percent of the engineers, and 28 percent of the technicians said they were considering such additional study.

Thus it appears that many of the students who recognize engineering as at least requiring a baccalaureate also see the desirability of further study at the graduate level. A substantial percentage of the technicians also seem to envision continuing their education beyond the two-year level to a bachelor's degree or even higher. On

College Plans as a Function of Vocational Choice

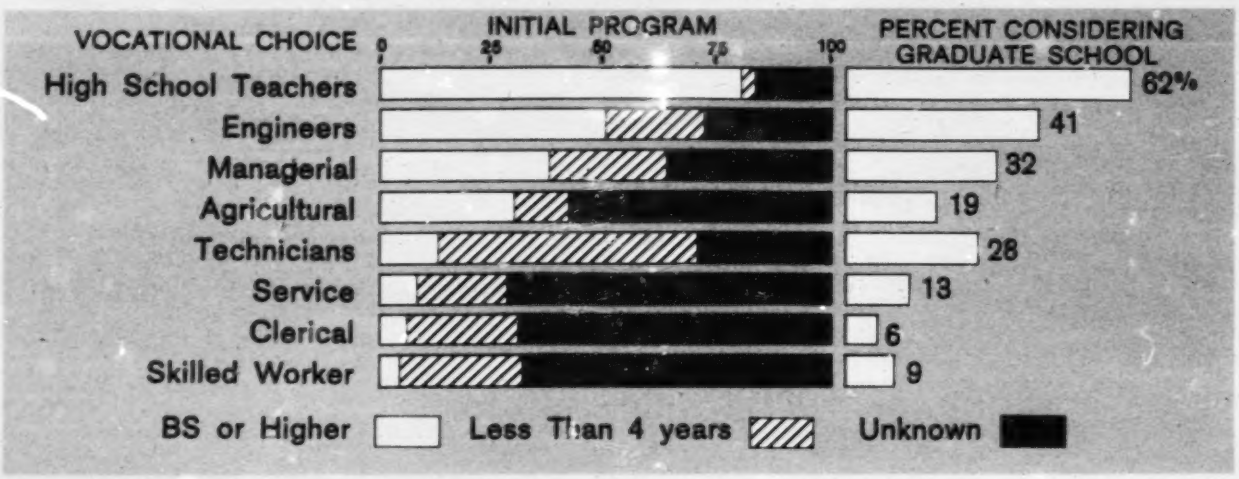

FIGURE 3

Occupation of Head of Household as a Function of Vocational Choice

VOCATIONAL CHOICE	PROFESSIONAL/ TECHNICAL	MANAGERIAL	CLERICAL	SERVICE	AGRICULTURAL	SKILLED WORKER
Engineer	36%	15%	7%	5%	4%	24%
High School Teacher	26	17	11	5	6	27
Technician	20	15	10	6	5	34
Managerial	17	33	10	6	4	23
Clerical	13	15	11	7	7	38
Service	15	14	8	10	6	37
Agricultural	14	12	6	3	33	26
Skilled Worker	12	11	7	7	6	48

TABLE 2

the other hand, a considerable number of students who think they want to study engineering appear to be vague about the educational requirements or even to have misconceptions as to the appropriate level of college program involved.

FAMILY BACKGROUND

Nearly three-quarters of the engineering and teaching students came from families whose head had less than two years of college. These two groups were quite similar in this respect, but differed noticeably from the technicians, whose parents tended to have a lower level of education. In general, seniors whose parents were college graduates were far more likely to choose professional, technical or managerial career fields.

The strength of parental influence is clearly apparent in Table 2. Engineering students were the most likely of the identified groups to come from professional and technical backgrounds, but they also had a strong input from families headed by skilled workers. Technicians, on the other hand, were more likely to have parents in the skilled worker category. Students choosing managerial, agricultural, and skilled occupations also tended to be drawn from families whose heads of household were in the same occupational category.

CAREER DECISIONS

Tables 3 and 4 compare the age at which students first became interested in a vocation and the age when they actually decided to pursue that career. Note that the engineers became interested over a wide range of ages

School Year of First Interest in Chosen Vocation

VOCATIONAL CHOICE	GRADES 1-6	GRADES 7-8	GRADE 9	GRADE 10	GRADE 11	GRADE 12
Agricultural	27%	16%	13%	13%	15%	14%
High School Teacher	14	20	15	15	22	13
Engineer	10	19	14	16	22	18
Service	9	15	13	16	23	21
Skilled Worker	8	15	14	16	25	21
Technician	7	11	11	16	25	28
Managerial	4	8	10	17	31	28
Clerical	3	9	17	21	29	19

TABLE 3

BEST COPY AVAILABLE

School Year of Decision on Chosen Vocation

VOCATIONAL CHOICE	GRADES 1-6	GRADES 7-8	GRADE 9	GRADE 10	GRADE 11	GRADE 12
Agricultural	5%	4%	8%	8%	19%	50%
High School Teacher	2	4	6	9	24	51
Engineer	2	4	5	9	24	53
Service	2	3	5	8	21	55
Skilled Worker	1	3	5	9	22	55
Technican	1	2	3	7	20	64
Managerial	--	1	3	4	17	68
Clerical	--	2	7	10	22	55

TABLE 4

with a slight peaking of interest at the junior year of high school. Technicians, however, tended to become interested near the end of high school, whereas agricultural students developed their interest very early in their youth.

For a majority of students the senior year was the time when they made a career decision. However, 44 percent of the engineering students had decided on that field by the junior year in contrast to 33 percent of the technicians. These figures indicate the importance of providing sound career guidance information at all levels, especially from the seventh grade up, in order to stimulate students' interest in engineering. The fact that most high school students attribute career decisions to their senior year is not surprising, as prior to that time they are under no pressure to make such a decision. However, studies of college students have shown that this high school career decision is far from final. The attrition of students who start out in engineering is well known, and unrealistic expectations and misunderstandings on the part of high school students are undoubtedly contributing factors.

Table 5 lists sources or people who were most helpful in making a career choice. The importance of having a personal example is shown by the high percentage of students who were influenced by a teacher to select teaching as a career. The statistics also reflect the importance of having close exposure to a field through parents or friends, relevant work experience (as in the agricultural, managerial, and skilled worker categories), or pertinent high school courses (as in the clerical field). No factors other than family influence stand out as strongly affecting the career choices of engineering & technician students,

Person or Source Most Helpful in Making Career Choice

VOCATIONAL CHOICE	RELATIVE	FRIEND	H.S. COURSES	WORK EXPERIENCE	TV, RADIO PRINTED MATERIAL	H.S. TEACHER	GUIDANCE COUNSELOR
Managerial	33%	16%	7%	23%	9%	7%	4%
Engineer	32	12	14	12	14	7	7
Service	30	30	3	7	16	3	5
Skilled Worker	30	18	8	21	6	10	4
Agricultural	30	15	3	29	13	4	3
Technician	27	17	10	10	18	8	8
Clerical	24	11	32	8	7	13	6
High School Teacher	20	10	18	12	6	27	5

TABLE 5

BEST COPY AVAILABLE

Most Important Reason for Choosing A Career

VOCATIONAL CHOICE	ACTIVITIES ON THE JOB	MONEY	PEOPLE I'LL WORK WITH	SERVING SOCIETY	LIKE TO WORK OUTDOORS	STATUS OR PRESTIGE
Engineer	51%	22%	4%	5%	6%	6%
Clerical	47	21	17	3	1	4
Technician	43	20	7	15	3	5
Skilled Worker	43	27	5	2	10	3
Managerial	43	23	14	4	4	6
High School Teacher	42	4	29	17	2	2
Service	35	13	19	15	3	3
Agricultural	26	5	2	2	61	1

TABLE 6

but neither can any be written off as negligible. The low rating given to guidance counselors has been observed in other studies and is really not surprising, because high school guidance personnel are primarily concerned with helping seniors gain admission to suitable college or vocational education programs, and ordinarily do not promote particular occupational choices.

Table 6 itemizes the most important reasons given by students for choosing a particular career field. Those selecting engineering mentioned, in rank order, activities on the job (51%), money (22%), outdoor work (6%) and prestige (6%). These reasons set engineering students quite apart from those planning to become high school teachers, whose reasons were: activities on the job (42%), people worked with (29%), and serving society (17%). Technicians tended to fall in between these two groups. Note also the entirely different pattern of the agricultural students, to whom outdoor work was a major attraction. A tabulation of second most important reasons (which are not included in Table 6) shows that money is rated very highly by prospective engineers and technicians, but not by students planning to become high school teachers.

It is probable that some reasons given are ambiguous (for instance, money to some students may signify immediate earnings in certain occupations, while to others it may mean expectations of high salaries in the future) and some may be unrealistic (most teachers actually seem to be concerned about the size of their salaries), but they do point to features of engineering which are already attractive as well as to some which could be presented to students in a more positive light.

SUMMARY

There are many differences in the characteristics of high school seniors, their educational plans, and the reasons why they choose certain vocational fields. The Purdue survey has pointed out areas of similarity as well as difference among Indiana students choosing engineering, technician, and other careers. Especially noteworthy is the contrast between students selecting engineering and those planning to become high school teachers. Although these groups appear to be similar in background, preparation, and academic ability, they are definitely different in other factors.

Similarly technician students, although frequently included in the broad professional & technical category, exhibit significant differences from engineering students when the two groups are analyzed separately.

The answers to several questions in the survey indicate that fairly large numbers of students may have an unclear understanding of the work done by engineers and technicians and the kind of college preparation required. Those planning to be teachers, on the other hand, seem to have more clearly defined goals and more realistic expectations about reaching them. Having family members in an occupation or being in close contact with someone working in a particular field (such as high school teaching) appear to be important factors influencing the career choice of students.

Although the survey findings are not without ambiguity or uncertainty as to interpretation, they should be helpful to educators, guidance personnel, and manpower planners who are interested in young people and their career choices.

ENGINEERING MANPOWER BULLETIN

Published by
ENGINEERING MANPOWER COMMISSION
OF ENGINEERS JOINT COUNCIL
345 EAST 47TH STREET, NEW YORK, N. Y. 10017
PHONE: (212) 752-6800 — EXT. 417
PRICE $2.00 PER COPY